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Procedia Economics and Finance 32 (2015) 1654 – 1666

Procedia Economics and Finance

www.elsevier.com/locate/procedia

Emerging Markets Queries in Finance and Business

The qualitative mathematical modeling of the ambiguity within internal audit using fuzzy logic in the forestry entities

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Abstract

This article aims to develop a theoretical and practical methodology for the exercise of internal audit of compliance in terms of fuzzy logic to determine or verify the degree of conformity of a forestry entity's activity with certain policies, rules, standards regulations, namely specifically in terms of how the preparation and reporting of accounting financial statements within autonomous administration in forestry. The approach of methodology used in this article is rarely used in practice, even though it is relatively complex, it is not very difficult to understand. In this context, fuzzy logic theory provides a research tool considered suitable to be applied to highly subjective aspects such as audit. Therefore, building an internal evaluation system based on fuzzy logic theory by internal auditors within the forestry entities, but not only would prove very helpful that this approach effectively deals with ambiguity and subjectivity encountered throughout the course of internal audits. That is why the implementation of such a system is a challenge for future researchers in the field of internal auditing, of elaboration and reporting manner of accounting financial statements within autonomous administrations in forestry or other entities, but also in terms of other internal audit aspects of the entities.

Selection and peer-review under responsibility of Asociatia Grupul Roman de Cercetari in Finante Corporatiste

Keywords: fuzzy logic, internal audit, regularity or compliance audit. Cod JEL: C53, D81, M42.

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Selection and peer-review under responsibility of Asociatia Grupul Roman de Cercetari in Finante Corporatiste
doi:10.1016/S2212-5671(15)01492-6

1. Introduction

Mathematics has managed to gain ground in terms of accuracy of digits which it provides and, indirectly the confidence regarding what lies behind the figures from various mathematical calculations, situation which can be observed in the economic activity of the entity, regardless of their legal form. When we say mathematics, we mean all direct or adjacent components such as statistics, econometrics, and mathematics applied to economics etc. In this way, there could not be without interest an attempt of theoretical approach regarding the exercise of internal audit of compliance in terms of fuzzy logic, which is a logic working with qualitative variables modeled by fuzzy numbers and has proven reliable in treating various problems in different fields.

Internal audit is an activity that contributes significantly to business decision-making to take precautions in order to conduct an economic activity which should be organized, efficient, effective, including rigorous compliance of management policy requirements, asset integrity, prevention and detection of fraud and error causes, accuracy, integrity, all accounting records and in time provision of reliable financial information, and more. Under these circumstances, the present paper tries to outline a theoretical framework with practical applicability, regarding the performance of the internal audit of compliance within an entity in general and within a forest entity in particular, taking into account the views, evaluation or judgment sometimes subjectively expressed by the expert auditor. These assessments are often materialized through linguistic values, that is, qualitative assessments of various audited situations or problems, vaguely and subjectively expressed, through words and not through exact figures.

As a result of these issues, this paper attempts the practical approach of the instrument related to fuzzy logic when an internal audit mission of compliance already in the framework of a forestry entity, conducted by an expert auditor and completed by the drafting of the report of internal audit. In this way, there is practically tried a validation, verification, confirmation of results obtained by classical actual work performed by the internal auditor during the internal audit mission of compliance by comparing the results of the audit mission report to those of the fuzzy methodology proposed in this paper. This aspect can mean, why not, testing the effectiveness of the fuzzy methodology proposed for implementation, which was designed by Pešić A. et al. (2012) in a special article in a magazine with the thematic of information systems and computers theory.

2. Research methodology

The main objectives considered in elaborating this paper relate to the development and application of a methodology related to the exercise of internal audit of compliance in terms of fuzzy logic to determine or verify the degree of conformity of an entity with certain policies, rules, standards or targets set in advance by its management or complying with the laws in force. Among the specific objectives of the paper, "theoretical and practical approaches for the exercise of internal audit of compliance in the forestry entities in terms of fuzzy logic" we mention: presenting the very important role which the existence of internal audit activity may have within a forest entity and not only, regardless of its type and its specific. Thus, the problem that often arises in practice of the entities is the difficulty and sometimes, ambiguity, which outlines the implementation or exercise of internal audit activity, as practical reality comprises a complex set of events, transactions, acts that need to be analyzed so that the findings and recommendations formulated to be appropriate, necessary and to lead to increasing the efficiency of the activity developed by the entity.

Other specific objectives which were sought to be achieved throughout the paper are: extracting the essence of internal audit of compliance, its features, components and other aspects of active participation of the internal audit to improve the efficiency of the activity performed by an entity; aspects to which fuzzy logic definition is added but also the characteristics and implications in various situations and especially in the possibility to use it in internal audit of compliance approach through the methodology of Pešić A. et al. (2012), with a view to reduce situations of uncertainty and subjectivity faced by auditors. Scientific management of the work stages in

this paper was based on the study of literature by research methods related to constructivism as current research, such as: documentation or review of specialized literature - especially the works published in various international databases due to the fact that fuzzy logic is a relatively new and innovative concern towards the effective treatment of ambiguity and uncertainty encountered in different economical contexts - analysis, synthesis, comparison, observation, attempts to verify the degree of compliance of the achieved results with those arising from the internal audit report drawn up by the internal auditor after having performed an internal audit mission at Forestry Department Alba A.A., interpretation of what has been studied and drawing conclusions. Thus, we tried to outline a theoretical methodology with further applicability in practical cases, having the fuzzy logic as basis, to determine the degree of conformity of various situations audited by an audit team consisting of more auditors; based on the study of Serbian authors Pešić A. et al. (2012), studying internal audit missions of compliance, conducted by the internal auditor had a significant contribution to the understanding and application of fuzzy logic in this field and in the reliability of the results obtained compared to those of the studied audit mission report.

3. Conceptualizing the internal audit of compliance

Internal audit is a complex activity based on the correlation, association, interrelation of several key elements that define this activity and ultimately will lead to the formulation of findings and recommendations recorded in the internal audit report through which, in most cases, value is added to that entity because internal audit is the activity able to make those findings and recommendations strictly related to the way in which events and transactions of the entity led to the achievements of the entity or not. This is all the more since, all findings and recommendations for all types of internal audit should form a coherent and essential information system that entity decision makers can base the future decisions.

The way in which the internal audit activity is addressed, assessed and appreciated depends on factors such as organizational culture, the role of the internal audit in the organization or shareholders' expectations. Granting the proper importance to the implementation and evaluation of internal control by selecting and implementing assessment activities established by the internal audit is a premise to ensure a systematic and disciplined approach of improving and streamlining procedures of internal control which, in turn, helps the entity in achieving organizational objectives. In this respect, for auditing the organization and conduct method of internal control within an entity, such as setting clear and relevant objectives of internal audit mission is one of the prerequisites that will determine, at the end of the mission, the establishment of the internal auditors' findings and recommendations regarding the method of implementation, operation of internal control activity within the entity.

Thus, using various audit techniques and tools, at the end of the mission, the internal auditor will come to formulate the findings and recommendations regarding the purpose of the audit mission, and auditing the method of organization and conduct of internal control within an entity, or compliance of situations from different perspectives. As audit techniques generally used, we can remember: checking performed to ensure validity, reality and accuracy of the accounting records of documents and conformity with laws and regulations, and internal control effectiveness etc. through the following vetting techniques: comparison, review, recalculation, confirmation, guarantee etc., physical observation, analysis, interview relationship notes. As tools used by the internal auditor to carry out the mission, we include: questionnaire of awareness, internal control questionnaire and checklist. All these audit tools and techniques, as we noted above, offer the possibility for the internal auditor (or auditors) to complete or draw up various materials throughout the course of the audit mission, and then substantiate the findings and recommendations made.

Therefore, the role of internal audit within entities, in assessing internal control as a whole, is significant, as reflected even in the way this activity is defined by the Financial Auditors Chamber Decision no. 88/19 April 2007 concerning the approval of internal audit Regulations. According to this decision, "internal audit is an

independent and objective activity which gives to the entity an assurance regarding the degree of control over operations guides the entity to improve its operations and contributes to adding more value. Internal audit helps the organization to achieve its objectives, assessing, through a systematic and methodical approach, its processes of risk management, control and governance of the organization and making proposals to strengthen their effectiveness. "(Financial Auditors Chamber Decision no. 88/19 April 2007 concerning the approval of internal audit Regulations).

Briefly analyzing the types of internal audit, the situation could be depicted according to the table below:

Table 1. Types of internal audit

Types of internal audit	Description
regularity or compliance audit	activities that provide assurance that all provisions implemented to apply the entity's internal rules for a feature are applied and work properly;
effectiveness audit	activities that provide assurance that all devices implemented to achieve a good control over a feature are appropriate, effective and should not be modified, removed or added;
management audit	activities that provide assurance that the policy regarding a function corresponds to the unit strategy;
strategy audit	activities that provide assurance that the development strategy of a feature corresponds, in terms of consistency, with the strategy of other entity or organization features.

Source: Tatiana Dănescu, academic course, 2010, Doctoral School, p.3.

If we proceed with more detailed analysis and radiography of specialized literature, we can identify several criteria for the classification of audit activity, but in this paper we only focus on the internal audit categories, so as to emphasize only topic of interest, respectively the audit of compliance, exercised from the perspective of fuzzy logic, by qualitative determination of the degree of mapping on a set of predetermined criteria, which will be which will be subject to a qualitative assessment of their weight of importance and the way in which the entity meets the performance requirements of these criteria, which can be represented in the procedure manuals adopted within an entity or a set of legal regulations.

As internal audit of compliance is concerned, following the conclusions we can draw after reading the literature cited in the bibliography (Tatiana Dănescu, Boța-Avram Cristina, Morariu Ana, Financial Auditors Chamber Decision no. 88/19 April 2007, Order no. 38/2003 of 15 / 01/2003, General rules for the exercise of internal audit activity of 15/01/2003, Law no. 672 of 19 December 2002, Joel Marcel, Briciu Sorin et al., Jacques Renard), we can state that this is the main anchor point of the work, subsequent and successive activities. the development of internal audit activity of compliance corresponds to the simple and traditional approach of internal auditor which will result in verifying the proper application of rules, regulations, procedures, job descriptions, organizational charts and so on, or, in other words, the internal auditor will compare the rule to reality i.e. what should be and what it is. The internal auditor, after having informed of what should be, indicates to the responsible person the possible imbalances identified, the activities that were not conducted, misrepresentations to the established provisions, after which the auditor identifies, analyzes the

causes and consequences of these phenomena and recommends what needs to be done in the future to apply normative acts in force or other rules specific to that area. Internal audit of compliance is known in the literature as internal audit of regularity, although some specialists' attempts shade differences between the two terms.

4. Fuzzy logic - quality mathematical tool in the evaluation of internal audit of compliance

To establish the compliance degree of a company activity according to initially set rules or targets, following the audit of compliance performance using fuzzy logic, we will make use of an original method designed by Pešić et al. (2012) - FSIF (Fuzzy Synthesis of Internal Factors), which is a systematic approach incorporating fuzzy logic for a better description of the actual situation of an entity. FSIF proposed method serves well the needs of modern Management Information System because it provides monitoring internal development of an organization over time and also comparing different organizations taking into account various factors and different weights.

The reason we use this methodology relates to the fact that both the assessments of criteria importance considered during the audit, and the way in which the company meets the performance requirements of these criteria, can be mostly made from a qualitative perspective, through linguistic values. Therefore, fuzzy logic comes to support the modeling of these qualitative assessments, which often express uncertainty, vagueness and subjectivity specific to human reasoning, expressed through linguistic expressions through words.

Fuzzy set theory has been developed since the '60s, in response to the insufficient consistency of deterministic reasoning "yes" or "no", trying the formalization of reasoning such as "more or less". In classical logic, propositions can be true or false, without the possibility of intermediate values. If approaching some specific models from the real world, there was the appearance of delicate situations: not all real systems are clear and deterministic, so they cannot be accurately described based on classical logic, and complete description of a real system requires a series of unknown or not completely provided information and often, not exactly understood. Thus, it appears necessary to use fuzzy sets and logic resulting from their use, instead of conventional sets, crisp.

Fuzzy set theory was developed by Zadeh (1965, 1999), who noted that the mathematical models and various classical methods in the foundation of decision-making process has flaws and are difficult to apply to complex reality of economic factors. As complexity of an economic process increases a critical point can be reached, from where precision and the significance of statements referring to process behaviour are incompatible. The incompatibility principle defined by Zadeh converges to vague statements (fuzzy), and fuzzy logic tries to create formalism for uncertainty and specific ambiguity of natural language, which can model it.

Let X be a domain of objects and a generic element x of the set X. A set in the classical sense A, included in X, is defined as a domain of elements such that each element x can either belong or not belong to set A. Defining a characteristic function for each element from X, function that can only have values 0 or 1, then set A can be represented by a string of ordered pairs of type (x, 1) or (x, 0), indicating that or, respectively.

In contrast to the set in the classical sense, a fuzzy set expresses the degree to which an element belongs to a certain domain of objects. Thus, the characteristic function attached to fuzzy set elements can have values in the whole interval [0,1], indicating the membership degree of each element in the domain. Let X be a domain of objects denoted generically by x. A fuzzy set A over set X is defined by a set of ordered pairs with the following form:

$$A = \{(x, \mu_A(x)) / x \in X\} \quad (1)$$

where $\mu_A(x)$ is called the membership function of fuzzy set A.

Membership function assigns each element of the set *X* a degree membership of the set *A*, which has a value in the interval [0,1]. If the membership function value is 0 or 1, then the fuzzy set *A* is a set in the classical sense, $\mu_A(x)$ being the characteristic function attached to the set *A*. Set *X* is called the universe of discourse and it can be discrete (with ordered or unordered elements) or continuous (isomorphic to the set of real numbers).

Constructing a fuzzy set depends on establishing the universe of discourse and the membership function. Choosing membership function is subjective, meaning that different people can choose different membership functions to express the same concept. This subjectivism arises from the differences between individuals with respect to their way of perception and expressing abstract concepts.

A fuzzy number *A* is a fuzzy set that has as universe of discourse real axis and satisfies the conditions of normality and convexity, set out below:

- fuzzy set *A* is normal if its core is a nonempty set (there is at least one element $x \in A$ so that $\mu_A(x) = 1$)

$$core(A) = \{x \in X / \mu_A(x) = 1\} \quad (2)$$

The core of a fuzzy set *A* is given by the set of elements $x \in A$ for which $\mu_A(x) = 1$.

- fuzzy set *A* is convex if and only if, for any $x_1, x_2 \in X$ and any $\lambda \in [0,1]$ the following relationship occurs:

$$\mu_A(\lambda \cdot x_1 + (1-\lambda) \cdot x_2) \geq \min\{\mu_A(x_1), \mu_A(x_2)\} \quad (3)$$

In theory there are two types of fuzzy numbers, triangular and trapezoidal, but in the following we will work with fuzzy triangular numbers. A triangular fuzzy number noted by $A = (a_1, a_2, a_3)$ can be represented graphically as in Figure 1, where it can be noticed that it is basically framed by three values, namely a_1 which is the lowest and represents the lower boundary of the number, a_2 which is actually the maximum of the membership function - $\mu_A(x) = 1$ and a_3 which is upper boundary of the number.

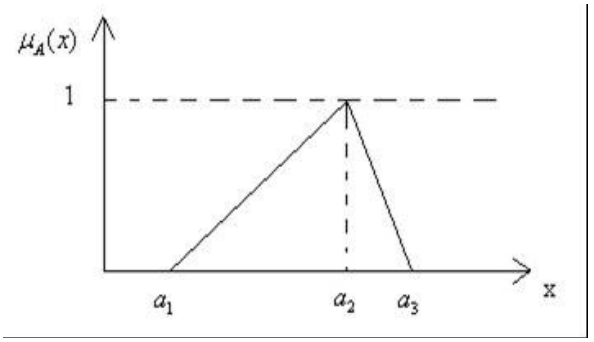

Fig. 1. Representation of triangular fuzzy number $A = (a_1, a_2, a_3)$

Basically, these fuzzy numbers include qualitative assessment of the various decision-making factors, and in our case, of qualitative evaluations of the auditor or audit team conducting an audit of compliance.

According to Zadeh's principles and research (1999), in case of two triangular fuzzy numbers $A = (a_1, a_2, a_3)$ and $B = (b_1, b_2, b_3)$, among them there may occur different operations, the following being the most common:

Addition: $(a_1,b_1,c_1)+(a_2,b_2,c_2)=(a_1+a_2,b_1+b_2,c_1+c_2)$ (4)

Multiplication: $(a_1,b_1,c_1)*(a_2,b_2,c_2)=(a_1*a_2,b_1*b_2,c_1*c_2)$ (5)

Fuzzy logic, as we mentioned in the previous paragraphs, is a very beneficial mathematical tool in modeling qualitative assessment of the various decision-making factors, but in the same time may be extended in other fields, such as, for example the current situation referring to the performance of internal audit of compliance within forest entities.

Therefore, the steps that outline the proposed methodology in this article, from the perspective of fuzzy logic are as follows (Pešić et al., 2012):

- Determine the actual objectives or criteria or factors considered in carrying out the findings of the internal audit mission of compliance
- The assessment is done through the use of interval [0.5]. Moreover, the proposed fuzzy model does not limit the total number of internal targets as it happens in other valuation methods because it does not require activity condition.
- Be $F_i,\ i=1,...,n$ the objectives that are determined to be relevant to an organization O. Their estimated value is $v_i,\ i=1,...,n$. This value belongs to the interval $[0,5]$. Four fuzzy sets are defined:
- $\underline{SMA}$ - "Major weakness"
- $\underline{SMI}$ - "Minor weakness"
- $\underline{FMA}$ - "Minor strength" and
- FMA - "Major strength"

Depending on the values obtained by the evaluation objectives, the degree of membership of each assessment of the objectives in each of the four fuzzy sets is calculated.

Graphical presentation of fuzzy sets defined can be seen in figure no. 2 where it can be noticed that an outcome of an objective assessment can be simultaneously both a minor weakness factor and a minor strength factor (in varying degrees), these ratings being obtained from fuzzy scores awarded by the internal auditor. For example, the assessment of objective F_i in Figure 1 belongs to the $\overline{SMA}$ set, with the degree of membership $\mu_{1\,i}$, in the same time belonging to the $\overline{SMI}$ set with the degree of membership $\mu_{2\,i}$.

4.1. Theorem 1. The sum of all degrees of membership obtained for each evaluated target must be equal to 1. For each objective measured F_i

$$\sum_{k=1}^{4}\mu_{k\,i}=1 \qquad (6)$$

Demonstration: Since we use triangular fuzzy sets, for an objective F_i with a value x the membership function $\mu_{1\,i}$ is equal to 1 for x belonging to the interval $[0,1]$. Further, $\mu_{1\,i}(x)=-x+2$, applies for $x\in[1,2]$ and is equal to 0 in the interval $[2,4]$. Similarly, $\mu_{2\,i}(x)=x-1$ is also valid for $x\in[1,2]$ and also $\mu_{2\,i}(x)=-x+3$ for $x\in[2,3]$. However $\mu_{2\,i}(x)=0$, for $x\notin[1,3]$.

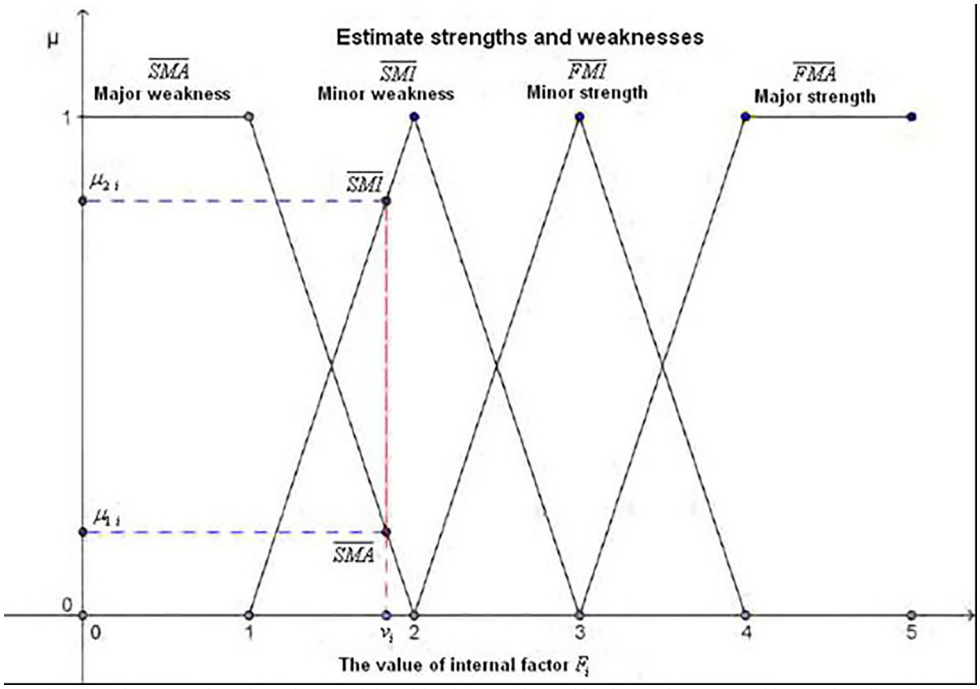

Fig. 2. Estimating the strength and weakness of the objectives envisaged in the performance of internal audit mission compliance

Similarly, we obtain formulas for the other membership functions.

If the objective assessment value is from 0 to 1, the degree of membership in $\overline{SMA}$ fuzzy set is equal to 1, and for all other fuzzy sets is equal to 0. If the value belongs to the interval $[1,2]$, then through the symmetry of graphs of the functions that represent SMI and SMA fuzzy sets on the line $\mu = 0.5$, the degree of membership to SMA set is equal to 1 minus the degree of membership to the SMI set and degree on the other two remaining sets is equal to 0. We can also demonstrate this using the formulas above and represented by SMA and SMI fuzzy sets. For example, for an assessed objective F_i with the value $x \in [1,2]$, we get:

$$\mu_{1\,i}(x) + \mu_{2\,i}(x) = (-x+2) + (x-1) = 1 \tag{7}$$

Similarly, we see that within the interval $[2,3]$, just two degrees of membership are different from 0 ($\overline{SMI}$ and FMI) and their sum is equal to 1. In the interval $[3,4]$, graphs of the functions FMI and FMA are symmetric on the line $\mu = 0.5$, therefore the amount of the corresponding degrees of membership is equal to 1 and the other two degrees are equal to 0. We prove the last assertion also using formulas for triangular fuzzy sets. Finally, within the interval $[4,5]$ only the membership degree of FMA is equal to 1, and the others are equal to 0. Therefore, throughout the field, the sum of membership degrees is equal to 1.

The same procedure is applied to all relevant objectives F_i, $i = 1,...,n$. Each objective assessment belongs, with a certain degree of membership, to SMA, SMI, FMI and FMA fuzzy sets.

The importance of relevant objectives is also considered. In this context, Pešić et al. (2012) suggest that the weight is taken from the interval $[0,2]$, resulting in the weight which increases or decreases the influence of some of the objectives on the overall state of the internal environment of the organization. The influence of an objective is low if the weight is in the interval $[0,1)$ and is increased if the weight is in the interval $(1,2]$. If the weight is 1, it has no impact on the objective value evaluated. The data obtained are presented in Table 1.

Table 2. Degrees of membership of the assessed objectives to fuzzy sets

Assessed objective	SMA	SMI	FMI	FMA	Weight
F_1	$\mu_{1\,1}$	$\mu_{2\,1}$	$\mu_{3\,1}$	$\mu_{4\,1}$	α_1
F_2	$\mu_{1\,2}$	$\mu_{2\,2}$	$\mu_{3\,2}$	$\mu_{4\,2}$	α_2
F_3	$\mu_{1\,3}$	$\mu_{2\,3}$	$\mu_{3\,3}$	$\mu_{4\,3}$	α_3
…	…	…	…	…	…
F_n	$\mu_{1\,n}$	$\mu_{2\,n}$	$\mu_{3\,n}$	$\mu_{4\,n}$	α_n

Multiplying the degrees of membership of the objective assessment , corresponding to fuzzy sets, observable with the weights of these objectives, we obtain weighted fuzzy membership degrees (Table 2).

Table 3. Weighted fuzzy membership degree

Internal objective	SMA	SMI	FMI	FMA
F_1	$\alpha_1\ \mu_{1\,1}$	$\alpha_1\ \mu_{2\,1}$	$\alpha_1\ \mu_{3\,1}$	$\alpha_1\ \mu_{4\,1}$
F_2	$\alpha_2\ \mu_{1\,2}$	$\alpha_2\ \mu_{2\,2}$	$\alpha_2\ \mu_{3\,2}$	$\alpha_2\ \mu_{4\,2}$
F_3	$\alpha_3\ \mu_{1\,3}$	$\alpha_3\ \mu_{2\,3}$	$\alpha_3\ \mu_{3\,3}$	$\alpha_3\ \mu_{4\,3}$
…	…	…	…	…
F_n	$\alpha_n\ \mu_{1\,n}$	$\alpha_n\ \mu_{2\,n}$	$\alpha_n\ \mu_{3\,n}$	$\alpha_n\ \mu_{4\,n}$

To determine the status of the internal environment of the organization as a whole, Pešić et al. (2012) determined the weighted arithmetic mean of the assessments of the degree of membership in SMA, SMI, FMI and FMA fuzzy sets objectives. For the first two sets, the degree of membership is taken with negative sign (for that is the weakness of the organization), and the other two fuzzy sets with positive sign (for that is the strength of the organization). Furthermore, the degree of membership to SMA and FMA are multiplied by 1.5, increasing their influence in the total amount, because they express a great weakness and great strength (Table 3). The factor 1.5 is an empirical value that is chosen to emphasize the major strength and weakness of the evaluation of the objectives.

Summing the values in the last column, we get a number I^O that indicates the current status of an organization's internal environment:

$$I^O = -(1.5)\sum_{i=1}^{n}\frac{\alpha_i\mu_{1\,i}}{n} - \sum_{i=1}^{n}\frac{\alpha_i\mu_{2\,i}}{n} + \sum_{i=1}^{n}\frac{\alpha_i\mu_{3\,i}}{n} + (1.5)\sum_{i=1}^{n}\frac{\alpha_i\mu_{4\,i}}{n} \tag{8}$$

The value I^O is a real number in the interval $[-3,3]$. If the resulting number is positive, the organization has more strengths than weaknesses and the higher the number, the better is the state of the organization. If the resulting number is negative, the organization has more weaknesses than strengths, and the smaller the number means that the state of the organization is worse.

Table 4. The weighted averages mean of the membership degrees

Assessed objective	SMA	SMI	FMI	FMA
F_1	$\alpha_1\ \mu_{1\,1}$	$\alpha_1\ \mu_{2\,1}$	$\alpha_1\ \mu_{3\,1}$	$\alpha_1\ \mu_{4\,1}$
F_2	$\alpha_2\ \mu_{1\,2}$	$\alpha_2\ \mu_{2\,2}$	$\alpha_2\ \mu_{3\,2}$	$\alpha_2\ \mu_{4\,2}$

F_3	$\alpha_3\ \mu_{1\,3}$	$\alpha_3\ \mu_{2\,3}$	$\alpha_3\ \mu_{3\,3}$	$\alpha_3\ \mu_{4\,3}$
…	…	…	…	…
F_n	$\alpha_n\ \mu_{1\,n}$	$\alpha_n\ \mu_{2\,n}$	$\alpha_n\ \mu_{3\,n}$	$\alpha_n\ \mu_{4\,n}$
	$-(1.5)\sum_{i=1}^{n}\frac{\alpha_i\mu_{1\,i}}{n}$	$-\sum_{i=1}^{n}\frac{\alpha_i\mu_{2\,i}}{n}$	$\sum_{i=1}^{n}\frac{\alpha_i\mu_{3\,i}}{n}$	$(1.5)\sum_{i=1}^{n}\frac{\alpha_i\mu_{4\,i}}{n}$

5. Case study on the application of proposed methodology in the autonomous administration of the forestry.

Regarding the topic of this paper to address internal audit in terms of fuzzy logic, we note that Omoteso (2012) discusses the application of artificial intelligence in audit, aspect outlining the matching of the benefits from the adoption of this artificial intelligence and their costs, thus, evaluating the impact of artificial intelligence on the design and monitoring of internal control systems and on the effectiveness of audit committees. Meanwhile, Azadeh et al. (2008) design and implement a fuzzy expert system to assess the performance of a health, safety, environment and ergonomics system in a gas refinery.

Regarding the specifically application of the methodology described in the previous chapter related to the exercise of internal audit of compliance mission from the perspective of fuzzy logic, we considered the final report prepared by the internal auditor in Forestry Department Alba A.A., drawn up on the occasion of the internal audit mission of compliance, on the compilation and reporting of accounting financial statements in 2010. The objectives envisaged in the performance of internal audit mission on the compilation and reporting of accounting financial statements are as follows:

- Analysis of the establishment and retrieval of the heritage as a result of GD no. 229/2009 on reorganization of Romsilva National Forest Administration.
- Analysis of the justification and approval of the annual budget of revenues and expenditures prepared by the Park Administration, amounts that are the annual value of management contracts.
- Substantiation of the fees of management services, that are the basis for invoices issued by Park Administration, with respect of the shares / activities in the annual work program prepared by the administration in accordance with the Management Plan.
- Compliance with the staffing and its specialization, according to management contracts, providing employment positions in management structure, according to the structure attached to the contract, the principles of functionality, improving the activity, ensuring working conditions and labor productivity.
- The conditions for keeping the destination of funds received from Romsilva NFA and justify the spending of them.
- Auditing the compilation and reporting of accounting and financial statements for fiscal year 2009.
- Auditing the compilation and reporting of balance sheet for the first semester of 2010.
- The way to access European funds, focusing on funds under Operational Programme "Environment" 2007-2013 (SOP) - Session I.
- Other tax returns monthly statements, external controls, etc.
- Management cases of provisions of Article 27 GEO No. 57 of 20 June 2007, (1) as a result of the permanent or temporary removal from agricultural or forestry circuit on the protected area of national interest.

However, in this study, it can be comparatively followed and verify if the work results of the internal auditor, respectively the conclusions and recommendations of the final report, correspond to the results provided by the application of this methodology based on fuzzy logic. Why not, if the results meet or are relatively similar, this methodology designed by Pešić et al. (2012) may prove its reliability in other economic situations that might apply.

After giving proper scoring according to the objective assessment of the internal audit report of compliance exercised by the internal auditor in this research study, the results are displayed in Tables 4, 5 and 6.

Applying the weights in the FSIF model, the data from Table 5were obtained.

Table 5. Assessment from the fuzzy perspective of the objectives taken into consideration in the performance of internal audit mission of compliance within the Forestry Department Alba A.A

Objectives	Value	*SMA*	*SMI*	*FMI*	*FMA*	Weight
1.	4,5	0	0	0	1	1,6
2.	4	0	0	0	1	1,2
3.	2,8	0	0,2	0,8	0	0,8
4.	5	0	0	0	1	0,8
5.	4,3	0	0	0	1	2
6.	4,6	0	0	0	1	1,6
7.	4,8	0	0	0	1	1,6
8.	1,8	0,2	0,8	0	0	1,2
9.	5	0	0	0	1	0,4
10	5	0	0	0	1	0,8

Table 6. The weighted membership fuzzy degrees

Objectives	*SMA*	*SMI*	*FMI*	*FMA*
1.	0	0	0	1,6
2.	0	0	0	1,2
3.	0	0,16	0,64	0
4.	0	0	0	0,8
5.	0	0	0	2
6.	0	0	0	1,6
7.	0	0	0	1,6
8.	0,24	0,96	0	0
9.	0	0	0	0,4
10	0	0	0	0,8

The results in Table 6 below are obtained by calculating the weighted arithmetic mean.

Weighted arithmetic mean following the calculations according to the methodology used.

Table 7. Weighted arithmetic mean following the calculations according to the methodology used

SMA	*SMI*	*FMI*	*FMA*
-0,036	-0,112	0,064	1,5

Following the calculations according to formula (6), by adding the weighted arithmetic mean obtained in each fuzzy set in the previous table, we get: I^O =1,416.

Since the value is positive, we conclude that the overall result of the internal audit mission reveals that the objectives are achieved at reasonable standards, rules and other regulations in force for Forestry Department Alba A.A.

Of course, for a positive result, almost equal to 3, which would reflect an ideal situation of practical work in Forestry Department Alba, reflected in the financial statements of the entity, it should be considered an improvement of objectives 5 and 8, and implementation of recommendations made for objectives 1 and 3, as shown in the internal audit report prepared at the end of internal audit mission on compilation and reporting of accounting financial statements. Also, assumption launched at the beginning of this chapter on comparing the internal auditor's work results, and the conclusions and recommendations of the final report, with the results provided by the application of this methodology based on fuzzy logic, in the sense that both results are relatively similar, was confirmed. Therefore, the results correspond or are relatively similar to those drawn from the audit report developed after performing the audit mission at Forestry Department Alba RA and this methodology designed by Pešić et al. (2012) and applied in the audited forest entity proves its reliability and can also be successfully applied in other economic situations, application that will be a concern of the authors to develop other such methodologies, outlined in other possible research papers that need to be sketched and disseminated in international conferences or specialty journals indexed in international databases. We emphasize this aspect all the more so as the diversity and complexity of the situations encountered in the current economic environment found in a continuous change and uncertainty, require addressing mathematical tools for qualitative modeling in addition to those based on statistical data, which makes fuzzy logic developed in a methodology as is the one presented in this article, and it really proves its reliability and contributes significantly to increasing the credibility of the results achieved from processing a qualitative perspective (linguistics) of the information provided to decision makers in the forestry entities and not only.

6. Conclusions

Sustainability of an entity's activity is subject to a large extent on the effectiveness of internal audit and the method in which the findings are formulated in a most objective and relevant manner. There are situations where the information underlying the performance of internal audit is ambiguous, which involves a subjective evaluation by auditors due to different contexts to which the set objectives refer to, subjectivity itself triggered by reasoning or abstract thinking of the human being, which is often manifested by the linguistic values. The methodology approached in this article represents a challenge for internal audit practitioners because it offers the possibility of providing reliable results in the internal audit report, under an economic environment increasingly complex and enveloped in uncertainty and due to subjectivity that internal auditors demonstrate in some cases when assessing different aspects and following to obtain asymmetry (asymmetrical) information in tasks performed. The results obtained in the case study in chapter 5 confirm the reliability of fuzzy methodology used in this article, which fully demonstrates its applicability degree relevant to the practice of internal audit. As research perspectives, can be also notice subsequent attempts of application and innovation of the methodology designed by Pešić et al. (2012) in terms of fuzzy logic in other test cases of financial accounting field. In the future, the reliability and accuracy of the results after applying fuzzy methodology described in Chapter 4, could create different software or a programming language either in a database in order to manipulate input data easily and to provide accurate results following arithmetic calculations.

Acknowledgements

This work was co-financed from the European Social Fund through Sectoral Operational Programme Human Resources Developement 2007-2013, projesct number POSDRU/CPP107/DMI 1.5/S/77497.

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